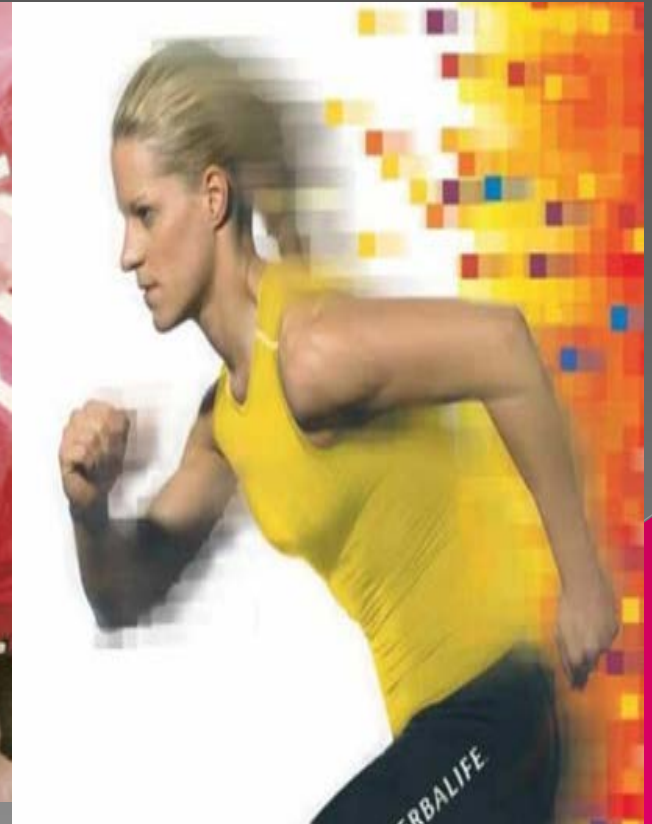


Creatine: The Wonder “Drug” of Sports

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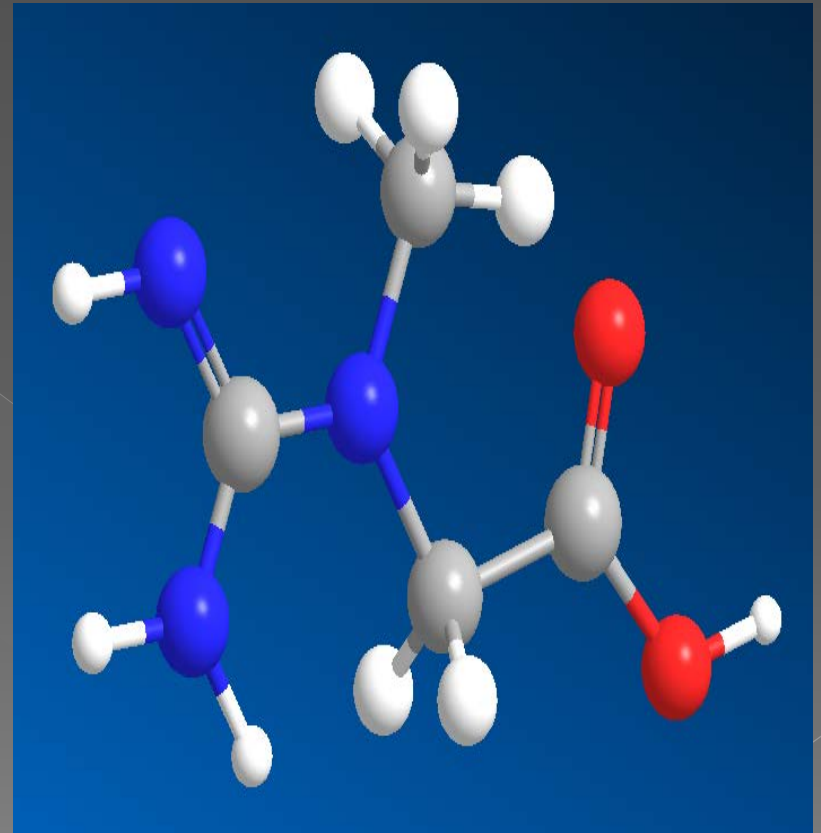
Introduction

- The supplement creatine monohydrate is used by athletes to gain strength and increase muscle mass.
- Considered the most popular sports supplement today.
- Over 30 years of research to test its effectiveness.



What is Creatine?

- Nonessential amino acid produced in liver and kidneys.
- Transported in blood to cells to aid in energy metabolism.
- A 73kg human body contains about 120 gram of Cr, mostly in muscle cells.



Creatine as a Supplement

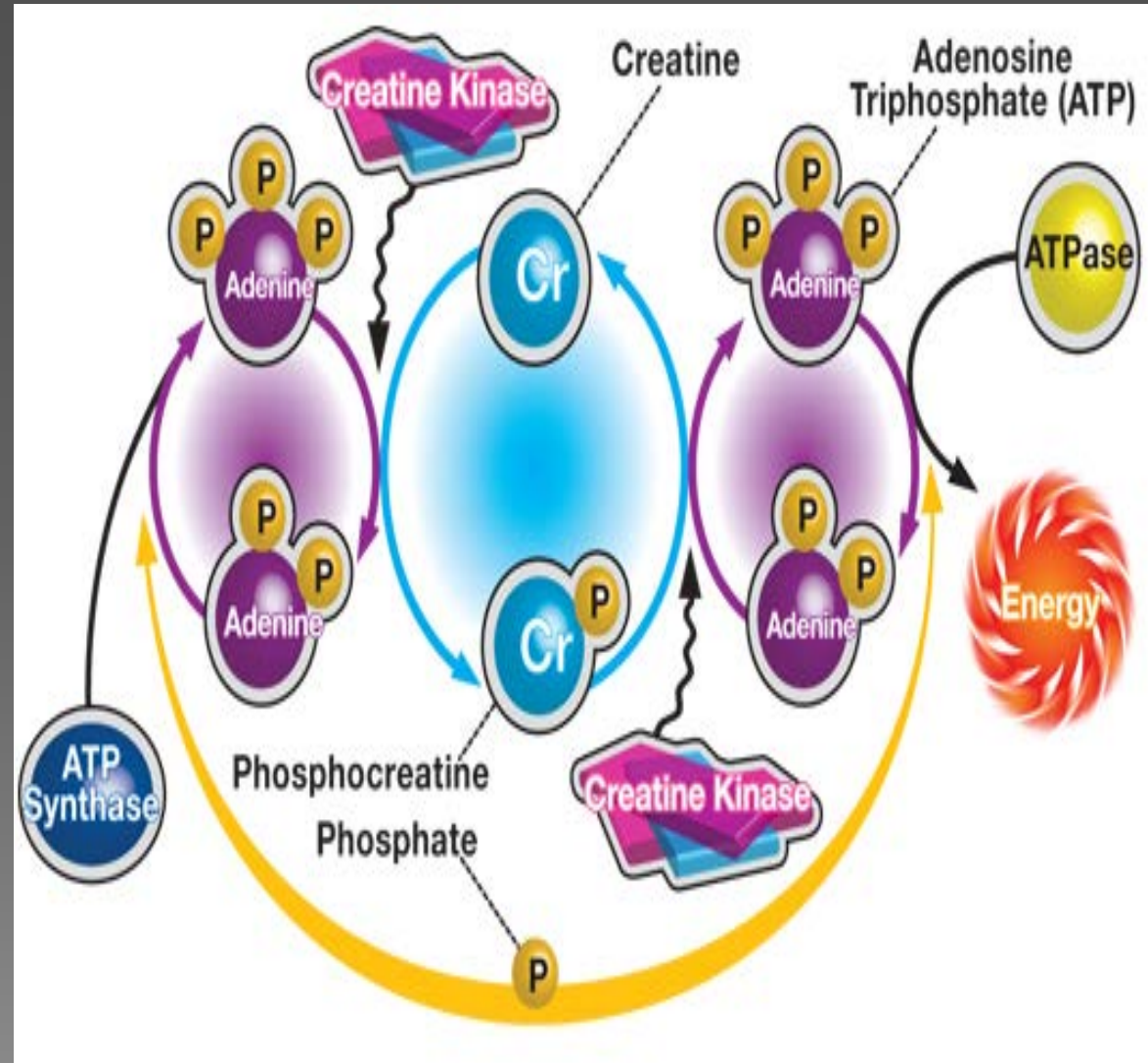
- Provide an increased supply of energy to muscle fibers for short-term high intensity action.
- Commonly formulated as creatine monohydrate.
- Natural sources: Beef and fish.
- Powder, tablet, ready mix drink. Consumed 15-30 minutes before exercise.



Enzymes

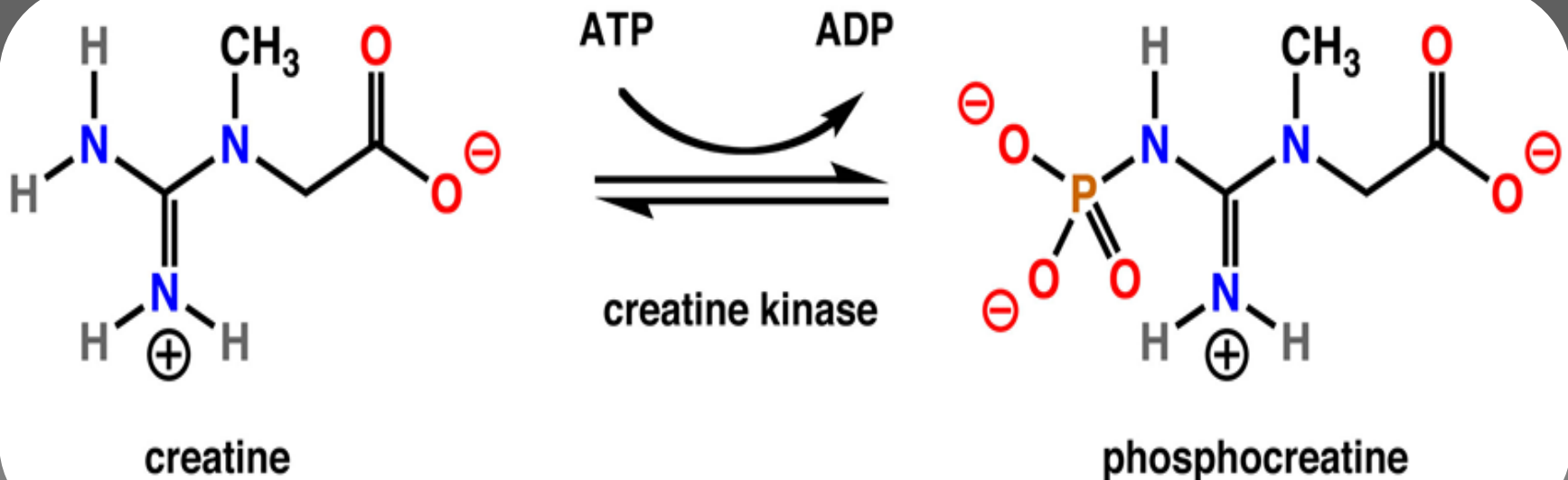
- ATP Synthase
 - $\text{ADP} + \text{P}_i \gg \text{ATP}$
 - Located in mitochondria
- ATPase
 - catalyze the formation of $\text{ATP} \gg \text{ADP} + \text{P}_i$
- Creatine kinase
 - A.k.a. Creatine
 - $\text{Cr} + \text{P}_i \gg \text{PCr}$
 - Reversible reaction
 - Requires ATP

○ Catalytic Activity of the Creatine Kinase/Creatine/Creatine Phosphate Cycle



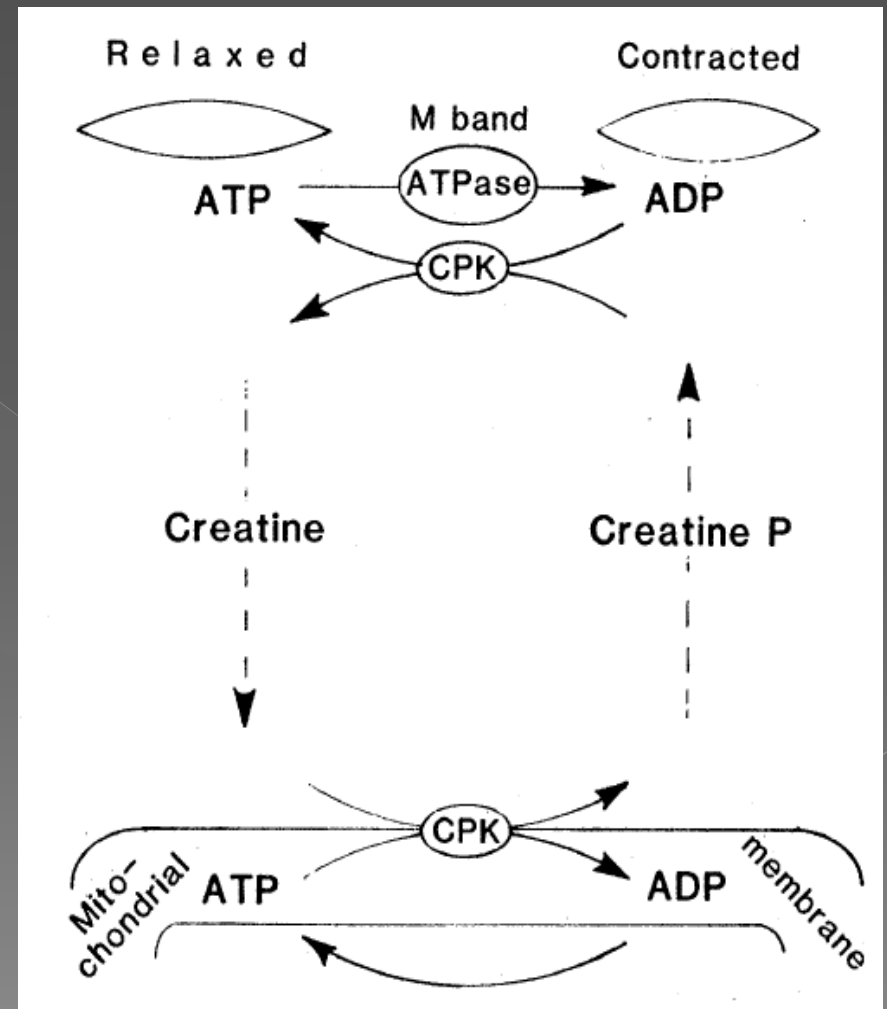
Phosphorylation

- The Creatine kinase enzyme catalyzes the forward and reverse reactions.
- CK levels are evaluated at first signs of heart risk
- Larger muscles contain more CK.

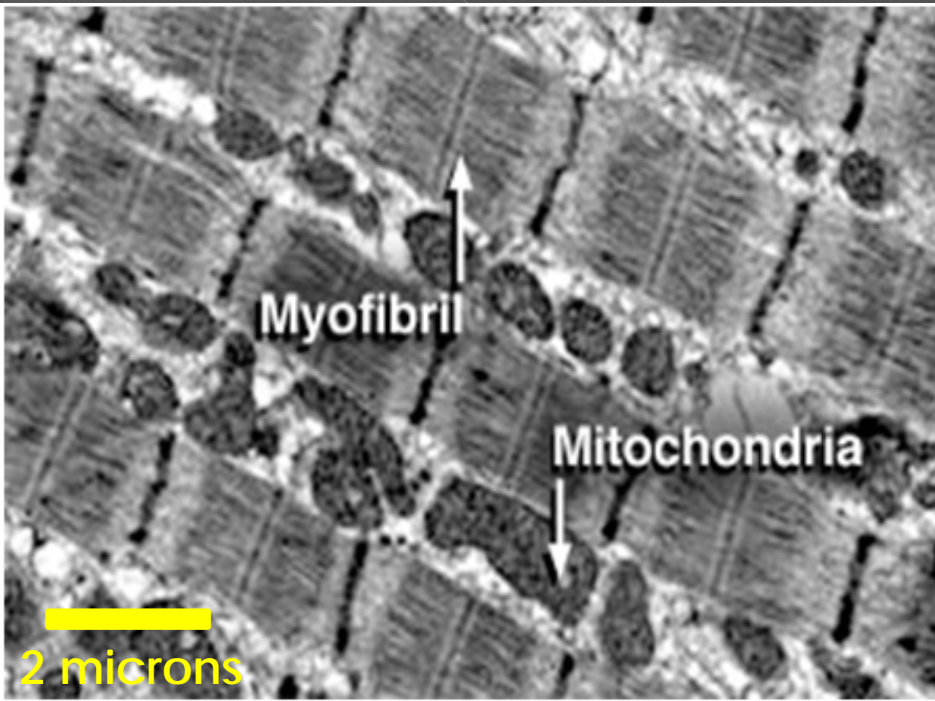


Energy Transport Shuttle

- Compartment between two CPK isoenzymes.
- Increase creatine concentration in cytosol stimulates mitochondrial CPK to signal ATP production.
- Has greater free energy than ATP production.

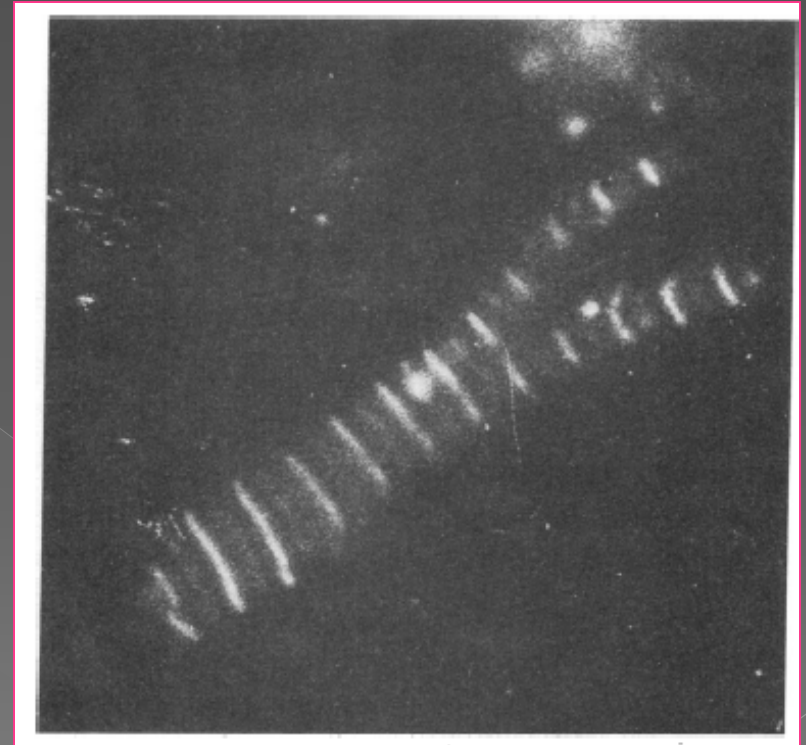


Mitochondrion-Myofibril Compartment



Electron microscope image at
25,000x magnification

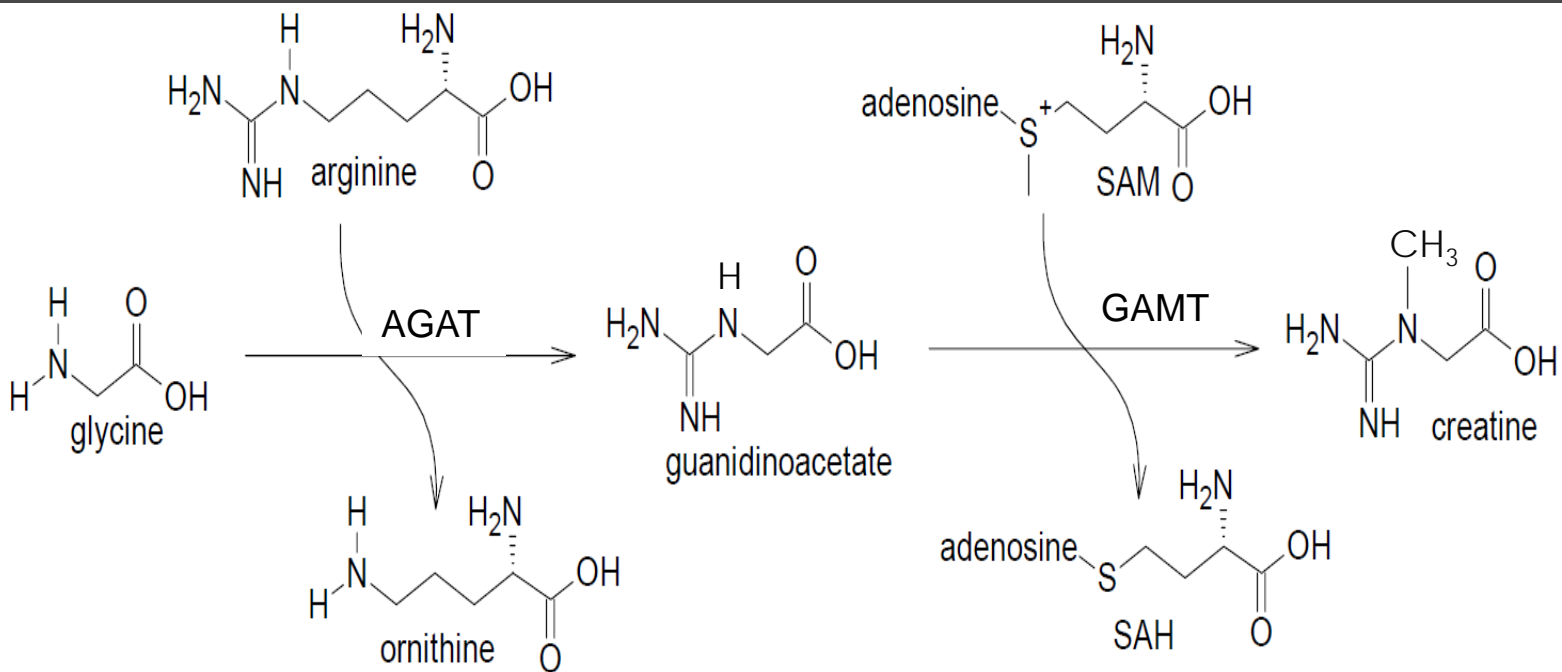
Source: <http://discoverysedge.mayo.edu/diabetes-metabolism/>



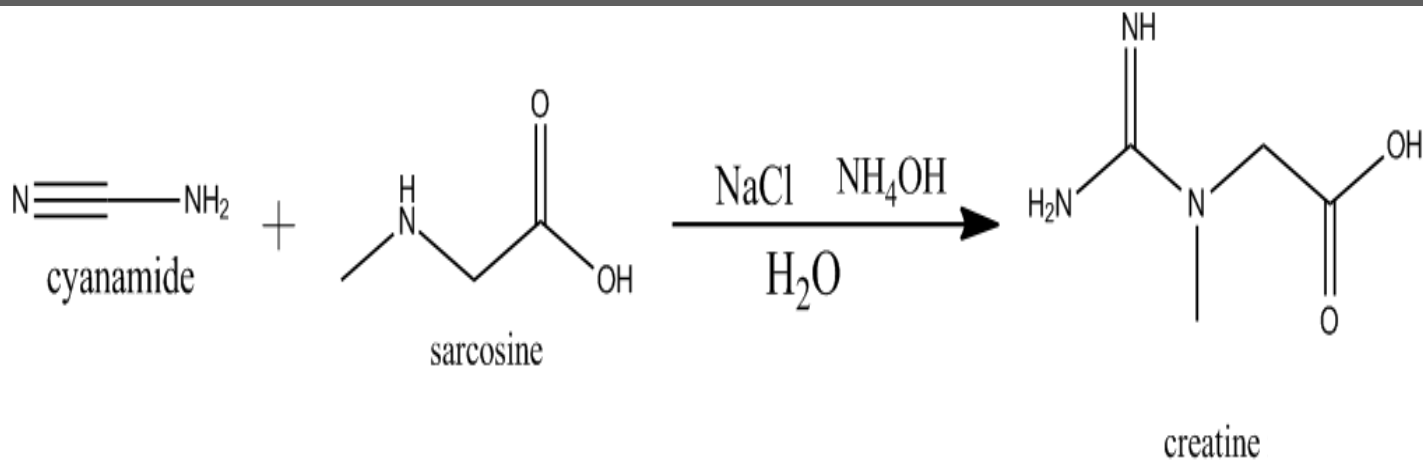
M-line of sarcomere at
50,000x magnification

Creatine Synthesis Mechanisms

Biological



Synthetic

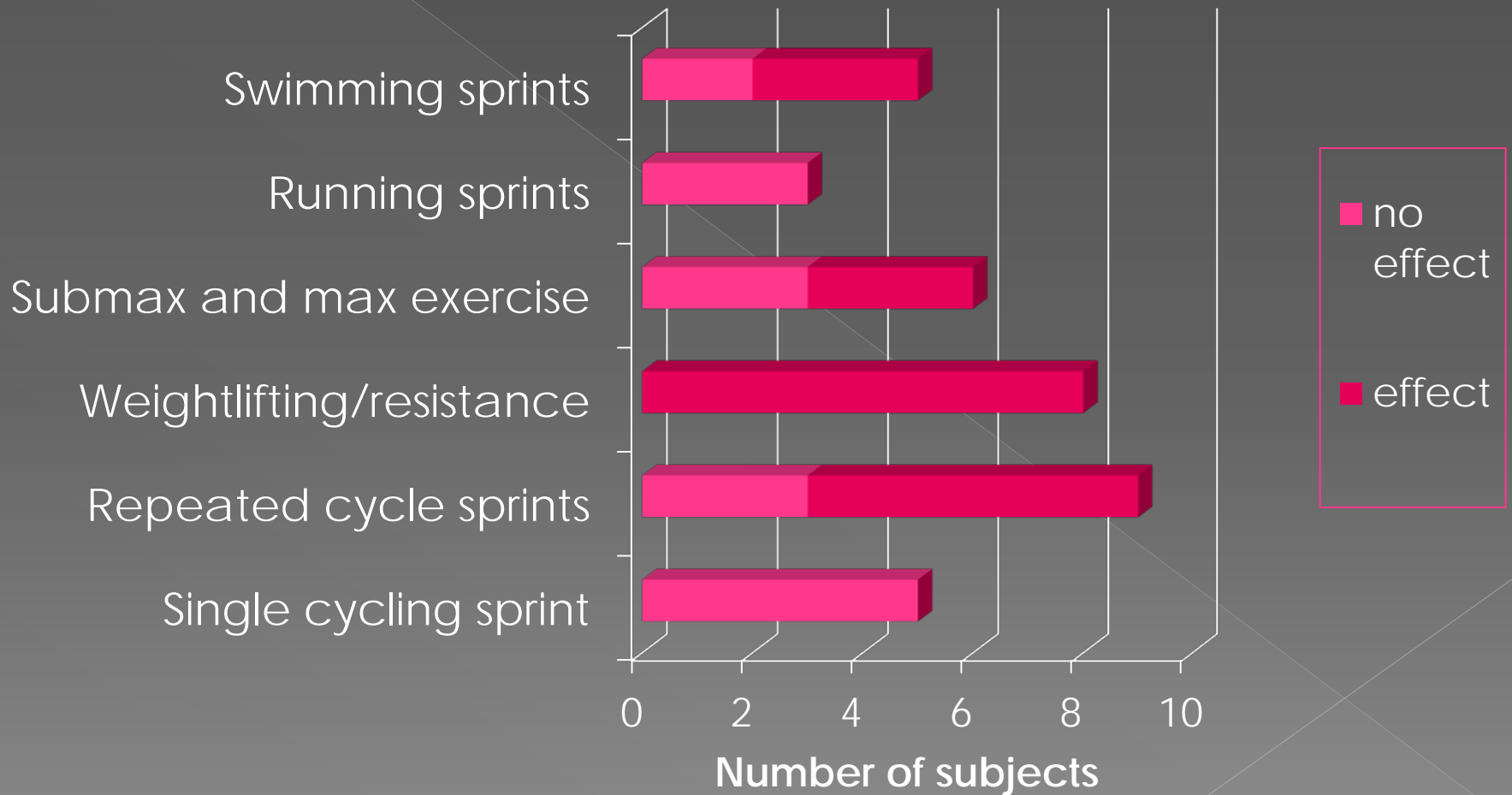


Creatine Supplement Theory

- ◉ Ample supply of energy
 - > Phosphocreatine saturation around muscle
- ◉ Rapid Regeneration of muscle-ATP
 - > High concentration of creatine available for rapid resynthesis of phosphocreatine
 - Mitochondrial creatine kinase is stimulated
 - Leads to more ATP production from mitochondria.
- ◉ Quicker recovery between workouts
 - > Supplement after workout

Creatine Research in Sports

Juhn & Tarnopolsky: Ergogenic Effects of Creatine Supplementation and Athletic Performance.



Creatine Research in Bench Press Test

Kilduff *et al*: Effects of creatine on isometric bench-press performance in resistance-trained humans.



Profiles of Creatine Users

Profile 1

The Bodybuilder

- High intensity 1 rep maximal lifts.
- Multiple reps & sets
 - > Increased strength
 - > Increased muscle mass
 - > Reduced recovery time

Profile 2

The Sports Athlete

- Football, hockey, baseball, rugby and possibly sprinters
 - > Increased explosive power and speed
 - > Increased body mass – (not good for sprinters)

Is Creatine Supplementing Safe?

- There have been no reported cases of serious injury or death directly related to creatine supplementation.
- Possible Side Effects
 - > Muscle cramping
 - > Dehydration
 - > Increase strains & sprains
 - > Renal stress
- Purchase high quality grade product

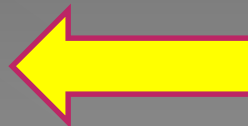
Q: Can One Overdose on Creatine?

- The answer is, "No."
 - › Signs of too much creatine would be stomach distress, nausea.
- Creatine is eliminated as creatinine by the kidneys.
 - › Elevated serum creatinine levels for 30 or more days following supplement.
- Creatine is non-addictive.

Creatine and the FDA

- Classified as a dietary supplement, Cr is not evaluated by the FDA before it is marketed.
- Manufacturers are responsible for stating claims on the labels.

"This product is not intended to diagnose, treat, cure, or prevent any disease."



CODE 677811 HKG

One of the most popular supplements among professional and amateur athletes, creatine provides support for immediate energy production during high-intensity workouts and plays an important role in muscle protein synthesis.* Over the past 10 years, numerous studies have shown that creatine supplementation helps to improve athletic performance and promote cellular hydration.*

DIRECTIONS: As a dietary supplement, take 5 capsules after your workout with 12 oz. of water.

Supplement Facts	
Serving Size	Five Capsules
Servings Per Container	24
Amount Per Serving	
Creatine Monohydrate	3.5 g*

* Daily Value not established.

OTHER INGREDIENTS: Gelatin.

WARNING: Consult your physician prior to using this product if you are pregnant, nursing, taking medication, under 18 years of age or have a medical condition. Discontinue use two weeks prior to surgery.

Potency verified by GNC procedure #5104.
Conforms to USP <2091> for weight.
Meets USP <2040> disintegration.

No Sugar, No Starch, No Artificial Colors, No Artificial Flavors, Sodium Free, No Wheat, No Gluten, No Corn, No Soy, No Dairy, Yeast Free.

* These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.

Medical Research of Creatine

- ◉ Muscular Dystrophy & Fibromyalgia
 - > Improve strength of degenerative muscle
- ◉ Congestive Heart Failure
 - > Allow patients to deal with exercise stress
- ◉ Minimize effects of concussion
 - > Reduce brain damage
 - > Possible requirement for NFL players
- ◉ Aid in cancer treatment
 - > Methylglyoxal therapy

Conclusion

- ◉ Creatine supplementation may increase strength and muscle mass.
 - > Must train with weights.
 - > Individual results will vary.
- ◉ Increased athletic performance is dependent on muscular strength.
- ◉ Consult with physician or dietician
- ◉ Creatine may be considered a drug, but not a medicine.

Acknowledgements

- ◎ I would like to thank:
 - > My family for their patience and support
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